APLHA MAGNETIC SPECTROMETER-02 (AMS-02) ASSEMBLY AND INTEGRATION PRODUCT VERIFICATION

NT/Quality and Flight Equipment Division

October 16, 2006
Baseline

Verify that this is the correct version before use

National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

Alpha Magnetic Spectrometer – 02 (AMS-02) Assembly and Integration Product Verification

October 16, 2006

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Change Record

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1.0 PURPOSE

This Work Instruction establishes procedures for JSC personnel in implementing and managing product verification functions for the assembly, testing and integration of the Alpha Magnetic Spectrometer – 02 (AMS-02) Payload in AMS-02 Collaborator's facilities. [Ref. JSC 63123, Section 6.1]

2.0 SCOPE

This work instruction (WI) applies to the AMS-02 Project Office (APO) quality assurance function at AMS-02 Collaborator's facilities for Structural Test Article (STA) integration and testing and AMS payload final assembly, integration, testing and delivery. It is used for flight hardware/equipment, ground support equipment (that interfaces flight hardware) and Special Test Equipment/Devices (STE/D).

It is also used to transfer hardware; to document controlled hardware configuration changes; to downgrade hardware; and to define status of hardware (active or inactive) within the S&MA Quality Assurance Records Center (QARC).

3.0 DEFINITIONS, ACRONYMS, and TERMS

AMS Payload: The flight hardware is referred to as the "AMS Payload" and is comprised of two parts: the "AMS Experiment" provided by the international AMS Collaboration and the "AMS Payload Integration Hardware (PIH)" provided by the National Aeronautics and Space Administration (NASA).

APO: AMS-02 Project Office.

Assembly & Integration (A&I) Activities: Activities involving assembly and integration of flight hardware/equipment, ground support equipment (that interfaces flight hardware) and Special Test Equipment/Devices (STE/D). It includes documentation and performance of procedures related to assembly and checkout, inspection, and integrated functional test.

Designated Verifier: An APO QA designee approved by the APO to perform secondary verification of selected MIPs. Designated verifiers **shall** perform secondary verification only on selected processes for which they are fully trained, qualified and approved by the APO. For the purposes of this definition, APO Designated verifiers shall be qualified NASA Civil Servants and Engineering Support Contract Group (ESCG) engineers. [Ref. SSP 41173C, Section 3.5.8, *Quality Assurance Designees*]

Government Mandatory Inspection Point (GMIP): Product assurance action, including product examination, process evaluations, product inspection or verification and record reviews, for which Government Quality Assurance performance is mandatory.

Mandatory Inspection Point – Verify (MIP - V): A specific point during a process whereby secondary verification is required, but the step does not require real time monitoring and witnessing by the DV or other quality representative and can be adequately verified after completion.

Mandatory Inspection Point (MIP): A specific point during a process whereby secondary verification (e.g., independent observation and verification) of a specific characteristic, operation, or test element is required before a product can be processed further. The inspection is performed by quality assurance (QA) personnel or a qualified designated verifier (DV) as authorized by the APO.

Secondary Verification: Independent verification, by inspection or test, of a product someone other than the one performing the task to verify conformance to specified requirements.

Secondary Verification Traceability: An indication such as an initial, stamp, employee number, identification number, or signature that the Secondary Verification of a task has been accomplished; shall be traceable to the individual performing the secondary verification.

Task Performance Sheet (TPS) – Special AMS-02:
A JSC Task Performance Sheet is used to provide control and establish a historical record of the following:
a. Hardware and software configuration change
b. Downgrading of "non-discrepant" hardware
c. Engineering investigation
d. Contractor's work authorizing document (e.g., Collaboration test, assembly or integration plan) when performing work at a AMS-02 Collaboration facility
e. Modifications to the original TPS (mod sheet)
f. Pre-ship and post-shipping inspection, evaluation, and processing
g. Product assembly
h. Product inactivation/reactivation
i. Testing activities

Type A TPS-Special: A TPS used to define, direct, and approve instruction that will effect a configuration change during assembly and integration.

Type B TPS – Special: A TPS used to define, direct, and approve instructions that will not effect a configuration change.

Verification Characteristics:
The following are some typical quality characteristics which shall be verified:
1) Critical drawing measurements and dimensions (including drawing notes and flags).
2) Mechanical parameters (e.g., function, torque, bonding, and jointing).
3) Electrical input and output parameters (including continuity and megohm test).
4) Critical parameters which cannot be verified at next higher assembly.
5) Inspection and test criteria for critical and special processes.
6) Verification of data pertaining to limited life and age controls.
7) Verification of lot and batch controls and source of controlled materials.
8) Handling of critical equipment and test articles.
9) Verification of calibration of instruments.

JSC Form 881, Subassembly Process Sheet: A form initiated by the Designated Verifier during assembly or integration of flight hardware to document inspection processes (e.g., crimping, soldering, tool calibration tag numbers, continuity testing)

4.0 QUALITY RECORDS AND FORMS

JF 1225, *Task Performance Sheet*
JF 941, *Pre-Lift Checklist*
JF 881, *Subassembly Process Sheet*
JF 2176, *Discrepancy Report/Material Review Board*
EA-018, *Task Safety Checklist*

5.0 SAFETY PRECAUTIONS AND WARNING NOTES

5.1 The Payload Integration and Test (PIT) Manager will utilize the safety regulations set in place at each of the integration or test facilities. Specific safety considerations shall be incorporated in each integration plan to address personal injury and loss or damage hardware. [Ref. JSC 63123, Section 7.8, *Safety*]

5.2 For hazardous operations, include as an attachment the applicable safety assessment in the in the Task Performance Sheet (TPS). See EA-CWI-001, Section 5.1, *TPS Hazard Identification Requirements* for guidance.

5.3 NASA (APO) will specify/inspect for all requirements that impact flight safety at all Collaborator facilities. [Ref. JSC 36123, Section 6.1]

6.0 REFERENCES

JSC 63123, *Alpha Magnetic Spectrometer – 02 (AMS-02) Assembly and Testing Integration Plan*
JSC 63164, *Quality Management Plan for the Alpha Magnetic Spectrometer – 02 (AMS-02) Experiment*
JSC 63335, *Requirements for Establishing Government Mandatory Inspection Points*
EA-CWI-001, *Task Performance Sheet (TPS), September 2006*
SSP 41173, Rev. C, *Space Station Quality Assurance Requirements*
NT-CWI-002, *Product Verification Plan (Self-Verification, Secondary Verification, and Designated Verification Programs)*
NT-CWI-003, *Quality Assurance Record Center Discrepancy Reporting and Tracking*

7.0 TOOLS, EQUIPMENT, AND MATERIALS

See EA-CWI-001, Section 7.0, Tools, Equipment, and Materials

8.0 PERSONNEL TRAINING AND CERTIFICATION

Personnel inspecting special processes (e.g., metallurgical and chemical processes, pressure vessels, welding, soldering, wire wrap and cable harnessing, contamination control, potting, bonding processes, plating and coating processes, surface treating processes) shall be trained and certified. [Ref. SSP 41173C, Section 3.1.5.2] APO DV personnel responsible for verification of mandatory inspection or secondary verification of flight hardware shall be trained in or familiar with quality assurance methods, practices, and principals.

9.0 RESPONSIBILITIES

9.1 AMS-02 Project Office (APO)
Authorized Designated Verifiers (DVs) by letter to the Chief, Quality and Flight Equipment Division.

9.2 Safety & Mission Assurance AMS-02 Point of Contact
ASA Civil Servant: Verify that persons performing duties as DVs have the requisite minimum training. Maintain objective evidence (e.g., training record, certifications) that DVs are qualified. Prepare metrics as required by the APO. Assist TPS Coordinator in tracking DRs.

9.3 TPS Coordinator
ESCG: Assure that all TPS are initiated, completed, closed, and entered into QARC correctly and timely. Assure that Discrepancy Reports (DRs) are recorded, dispositioned, tracked, and closed.

9.4 APO Project Designated Verifiers (NASA Engineers and Contractor Engineers)

Complete minimum training as required. Review assembly and integration plans and prepare TPS with assistance from TPS Coordinator. Have TPS and assembly and integration plans reviewed by QE/QA to assign MIPs. Complete the work required for each assembly or integration TPS. Coordinate and work with the TPS Coordinator to complete TPSs in a timely manner.

9.5 Quality Assurance personnel:

(APO Designated verifiers may be qualified NASA Civil Servants, qualified Engineering Support Contract Group (ESCG) engineers, ESCG QA personnel, and Defense Contract Management Agency (DCMA) personnel)
Review assembly and integration plans as needed. Perform QA functions at Collaborator facilities.

9.6 AMS-02 Project Safety Personnel:

Review drawings or assembly and integration plans for critical or safety critical characteristics and apply MIPs as required.

10.0 PROCEDURE

10.1 TPS Overview and Applicability

The Test Performance Sheet (TPS) is a work authorization document used to provide, control, document, and establish a historical record for the assembly and integration of AMS Payload hardware/equipment, ground support equipment (that interfaces flight hardware) and Special Test Equipment/Devices (STE/D). It includes documentation and performance of procedures related to assembly and checkout, inspection, and integrated functional test. It is also used to transfer hardware; to document controlled hardware configuration changes; to downgrade hardware; and to define status of hardware (active or inactive) within the Quality Assurance Records Center (QARC).

10.2 TPS Types and Uses

10.2.1 Type A TPS: A TPS used to define, direct, and approve instruction that will effect a configuration change during assembly and integration.

10.2.2 Type B TPS: A TPS used to define, direct, and approve instructions that will not effect a configuration change.

10.3 TPS General Requirements

The initiator is responsible for clearly defining the task so that it can be performed safely and effectively. In the main body, specify all the steps necessary to accomplish the scope. This may simply refer to an attached assembly or integration plan. As a minimum: (1) Identify MIPs by item number or title; (2) Identify steps that involved "controlled" equipment; (3) Document safety instructions for tasks; and (4) Identify steps that satisfy a requirement for Acceptance or Hazard control verification with a note referencing the specific requirement by document and paragraph number. See EA-CWI-001*, Section 10.3 TPS General Requirements* for additional guidance.

10.4 TPS Usage and Constraints

Individual TPS content shall be limited to related processes or a specific objective. The TPS is not intended for use in ongoing data collection applications with no closure criteria. TPS scope shall not require the TPS life cycle to exceed one year.

10.5 TPS Process

10.5.1 Initiation
Use EA-CWI-001~~,~~ *Section 10.5.1* as applicable to the AMS Payload.

10.5.2 Review
Use EA-CWI-001*, Table 10-1 TPS Review Responsible* as applicable to the AMS Payload. Add AMS Project Safety personnel as mandatory reviewer for AMS Payload safety constraints

10.5.3 Approval
Personnel designated on the current APO Signature Authority Letter.

10.5.4 Other Specialty Approval Signatures Required
Use EA-CWI-001*, Section 10.5.4* as applicable to the AMS Payload.

10.5.5 Work Performance
Use EA-CWI-001*, Section 5.5.5* as applicable to the AMS Payload.

10.5.6 Modifications and Cancellations
Use EA-CWI-001*, Section 10.5.6* as applicable to the AMS Payload.

10.5.7 Acceptance and Close-out
Use EA-CWI-001*, Section 10.5.7 Review Responsible* as applicable to the AMS Payload.